Advanced QuickTime Programming Techniques

Session 716

Advanced QuickTime Programming Techniques

Tim Cherna
Engineering Manager
QuickTime A/V Foundation

What You Will Learn

- Thread safety
- ColorSync integration
- Audio/Video startup sync

Technology Framework

- QuickTime
- ColorSync
- Quartz
- CoreServices

Multithreaded QuickTime

Sam Bushell
QuickTime Engineering

Problem

- Some operations are slow
- Blocking UI on main thread is unpleasant
- Enable slow work to be done by background threads

Which Operations?

- Still image import/export
- Opening movies
- Movie rendering
- Movie compression and export

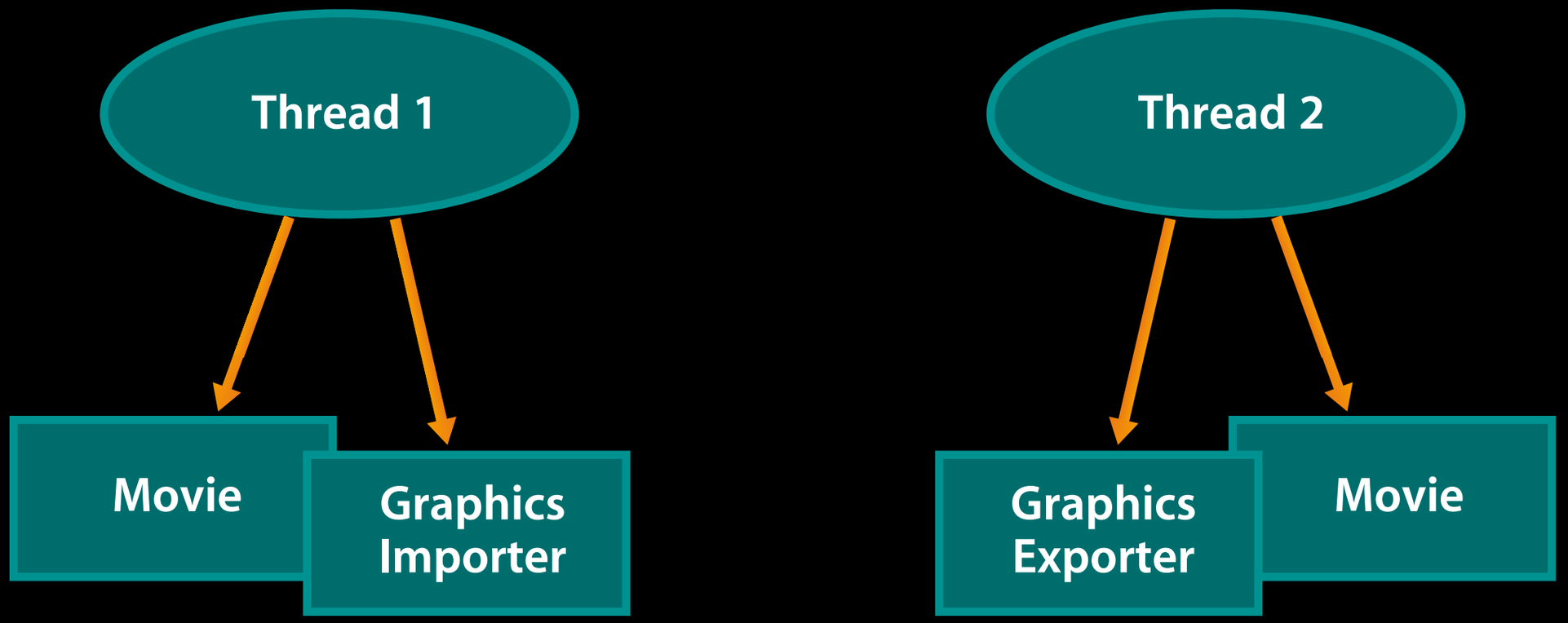
- Not playback

How Safe?

- Independent threads should be able to work on logically disjoint objects

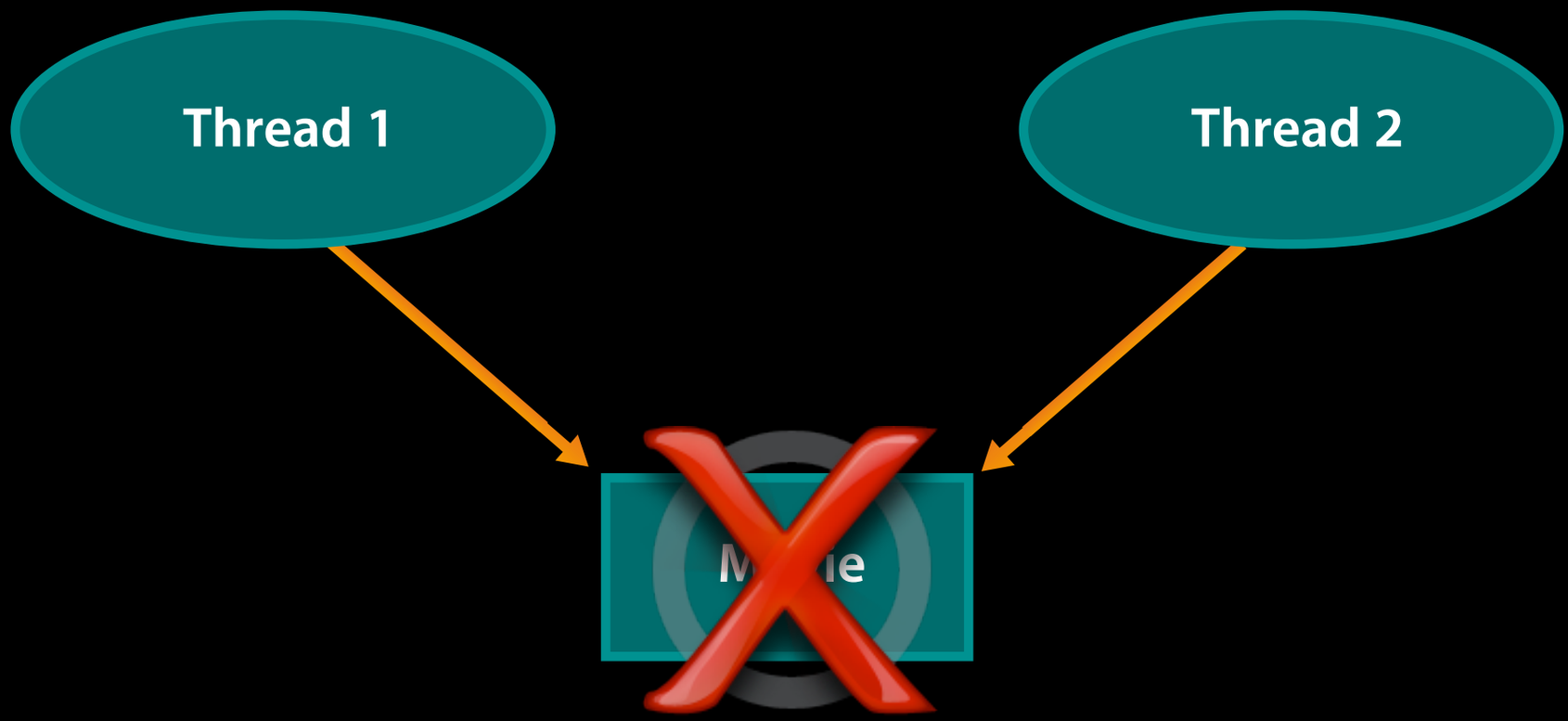
Disjointness

OK



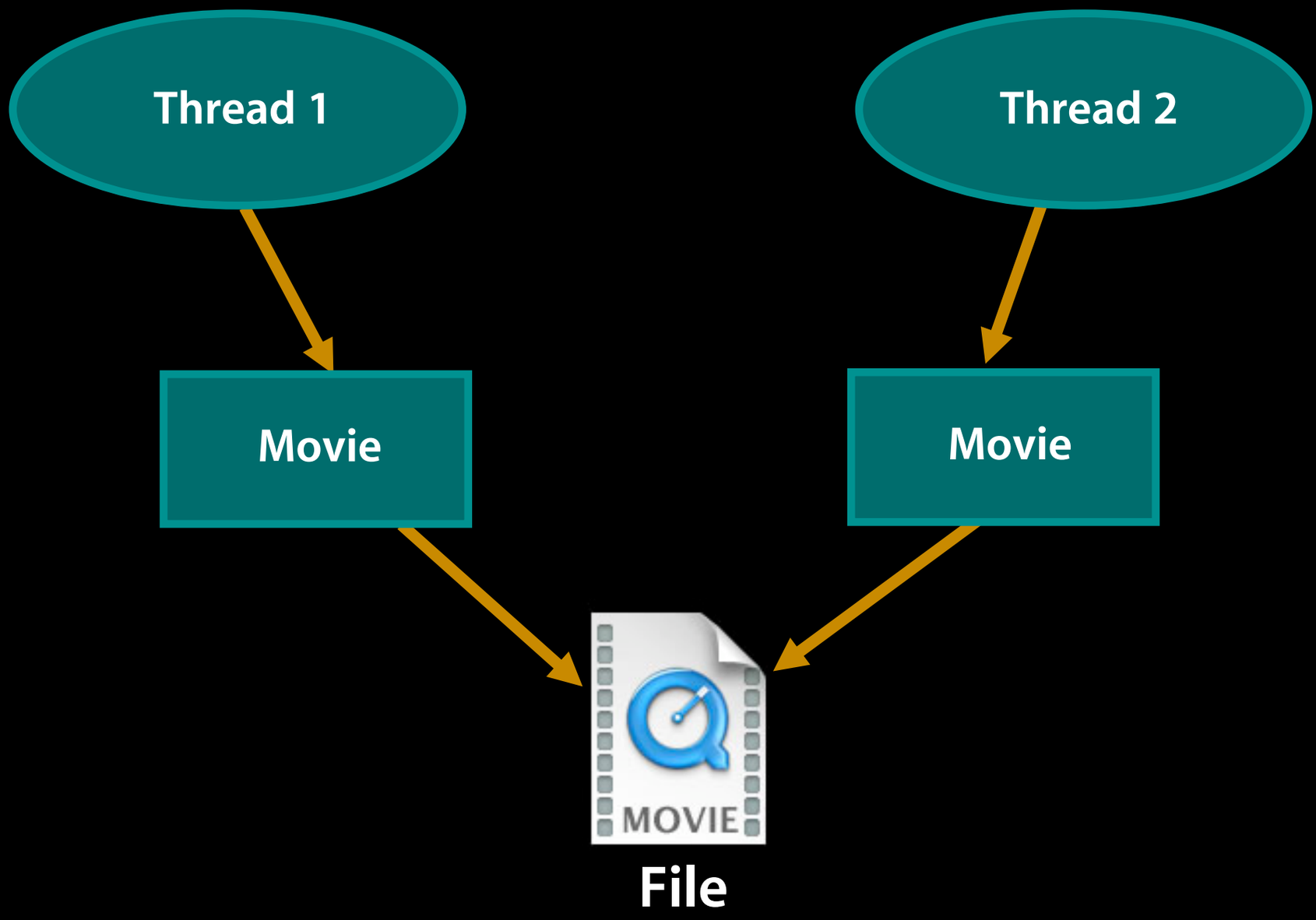
Disjointness

Not OK



Disjointness

OK

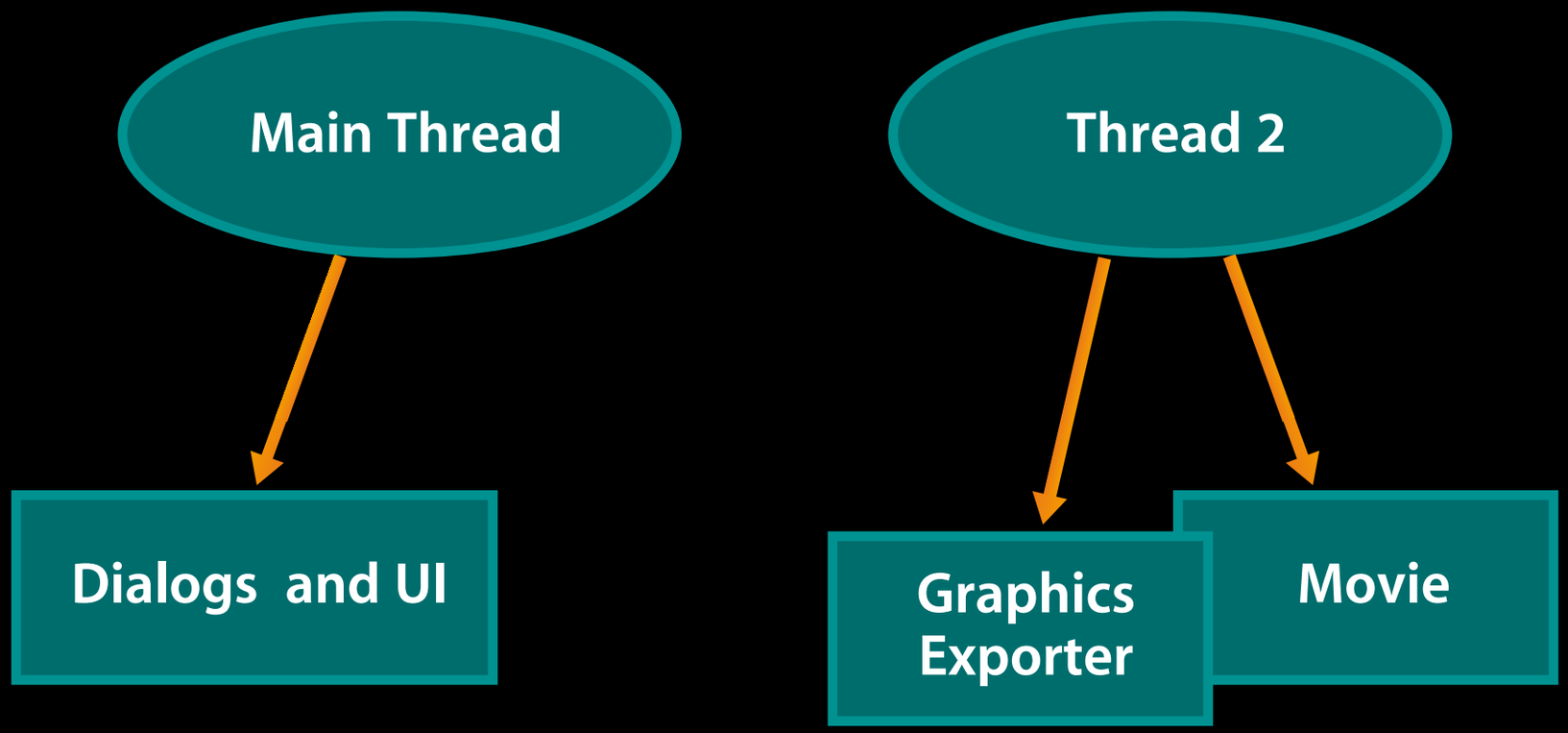


How Safe?

- Do not let two threads work on the same object at once
- Caller's responsibility

How Safe?

- HIToolbox is not thread-safe
- UI still has to live in main thread



Where?

- Panther and later
- Not on Jaguar, even after QuickTime updates

Demo: Multithreaded Image and Movie Processing

Tim Cherna

Caveat

- Some components are not thread-safe!
- High-level QuickTime operations use many low-level components
- Some image files and movies cannot safely be used from threads

Rules for New Threads Who Call QuickTime

- Call `CSSetComponentsThreadMode(kCSAcceptThreadSafeComponentsOnlyMode)` early on
- If you get `componentNotThreadSafeErr`, the main thread must do the work instead

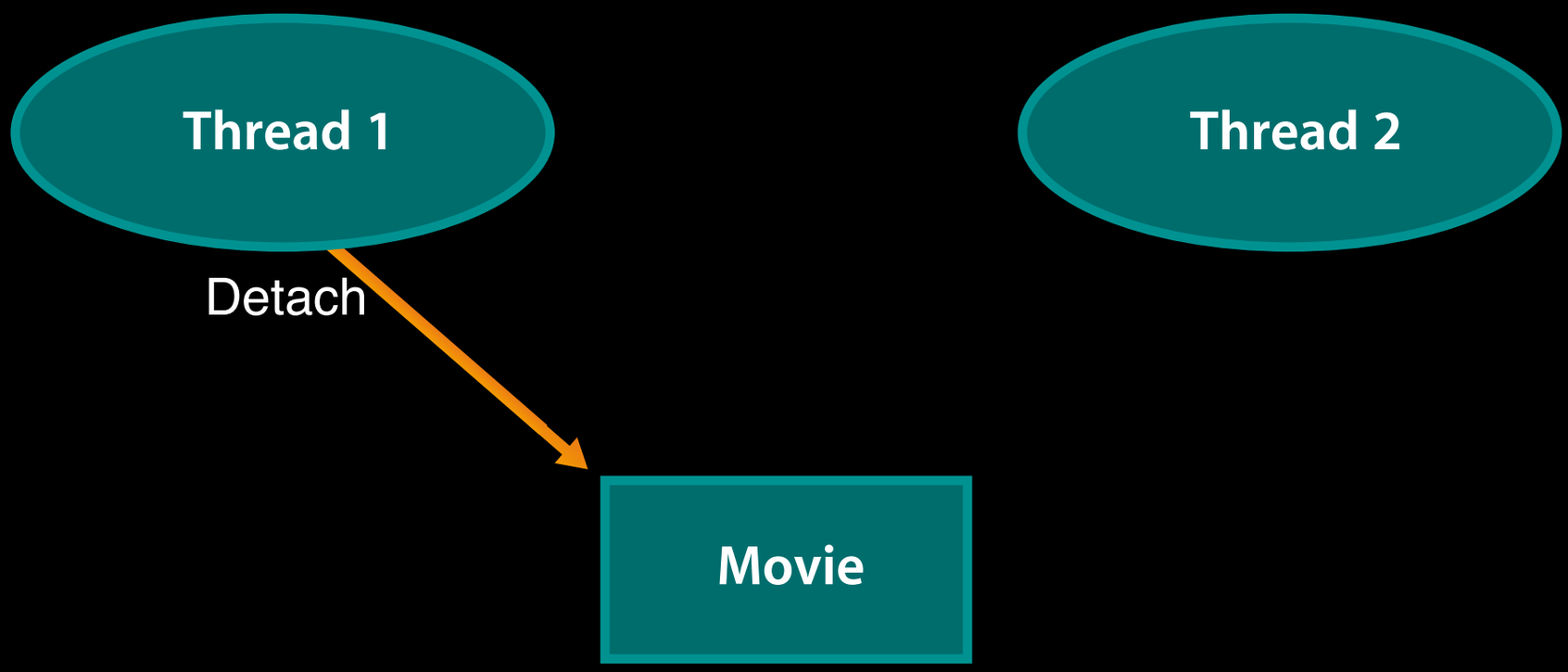
WWDC Panther Seed

Thread-Safe	Not Thread-Safe
JPEG, GIF, TIFF, PNG, PhotoShop, JPEG 2000	MacPaint files
Open Movies*, DV clips	Opening text movies, Text Media handler
DV, JPEG codecs	H.261, H.263, SV codecs
Export Movies, DV clips	Export Hinted Movies

Use these to test your retry code!

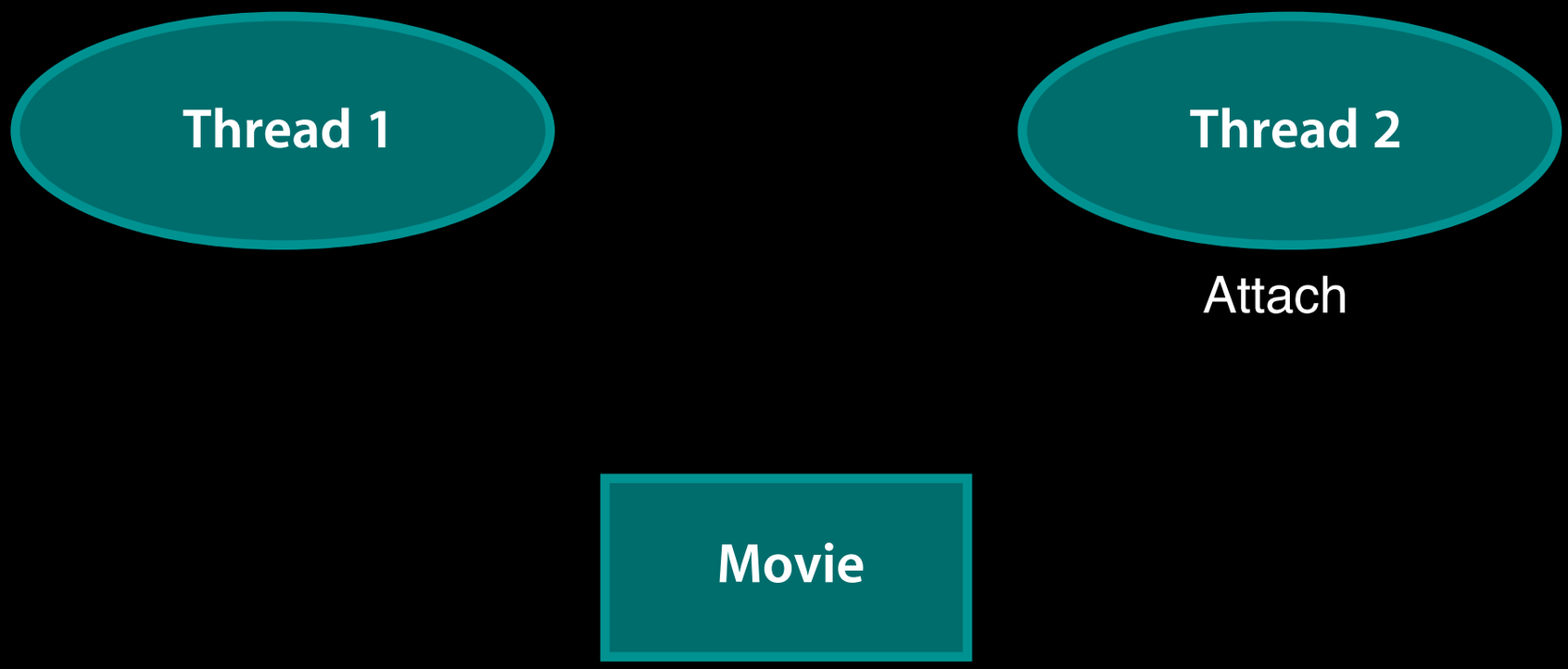
Migration

- If you pass a Movie from one thread to another
  - `DetachMovieFromCurrentThread` in old thread
  - `AttachMovieToCurrentThread` in new thread
- Otherwise it might get tasked in the wrong thread



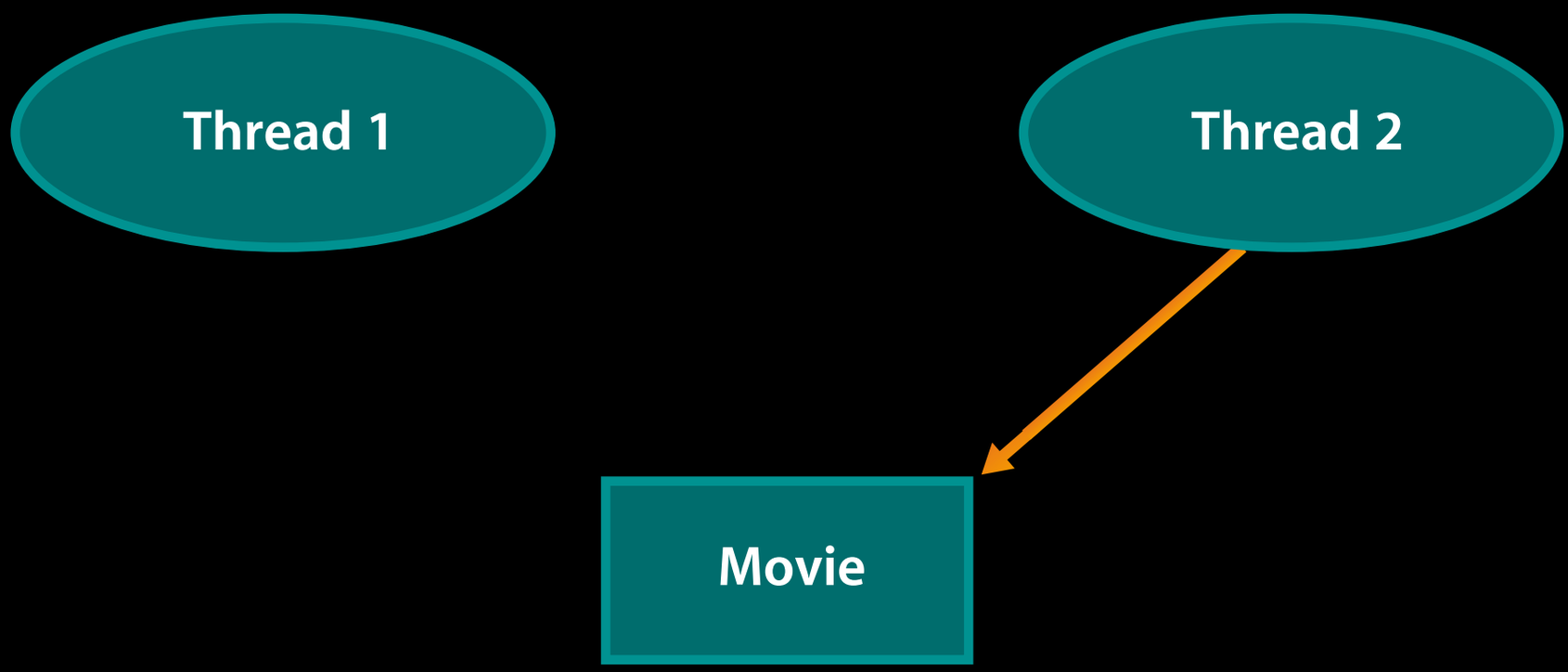
Migration

- If you pass a Movie from one thread to another
  - `DetachMovieFromCurrentThread` in old thread
  - `AttachMovieToCurrentThread` in new thread
- Otherwise it might get tasked in the wrong thread



Migration

- If you pass a Movie from one thread to another
  - `DetachMovieFromCurrentThread` in old thread
  - `AttachMovieToCurrentThread` in new thread
- Otherwise it might get tasked in the wrong thread



Callbacks

- Asynchronous completion callbacks may called from special threads
- Other callbacks are called from the same thread that is doing the work
- Be careful how you implement progress callbacks
  - HIToolbox is not thread safe

Calling Component Developers…

- Make your components thread-safe!
- Then set `cmpThreadSafe` flag

Newly Thread-Safe in Panther

- QuickDraw
- Component manager
- Alias manager
- Memory manager
  - Per-thread `MemError`
  - `malloc`() and `calloc`() are faster, but many APIs use Handles

What Is Not Thread-Safe?

- Resource manager
  - Because of the resource chain
  - But `GetComponentResource` and other one-shot calls are OK

What Is Not Thread-Safe?

- Component RefCons for shared globals
  - Use protected static variables to share state instead
  - Use static const data for constant tables instead

Thread Safety Summary

- Unblock your UI by moving slow QuickTime processing to other threads
- Cope with dynamic discovery of non-thread-safe media
- Make your components thread-safe!
- Panther only

QuickTime and ColorSync

Sam Bushell
QuickTime Engineering

APIs

- Graphics Importers
  - Easy-to-use API for drawing still image files
- Graphics Exporters
  - Easy-to-use API for exporting still image files
- ColorSync
  - Provides services to match colors between profiles

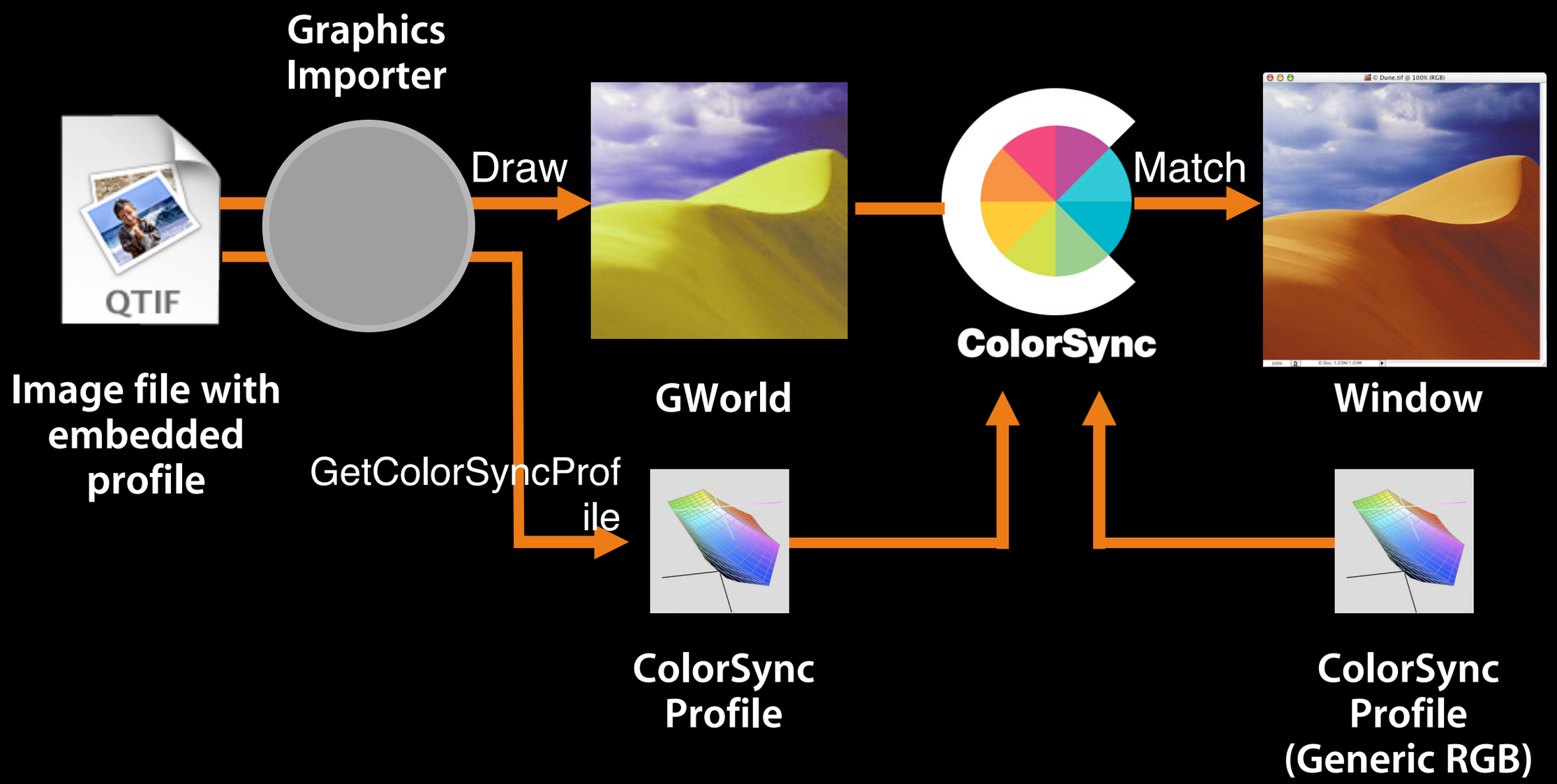
Embedded Profiles

- Many still image formats can contain embedded ColorSync profiles
- Graphics Importers and graphics exporters provide APIs to access them

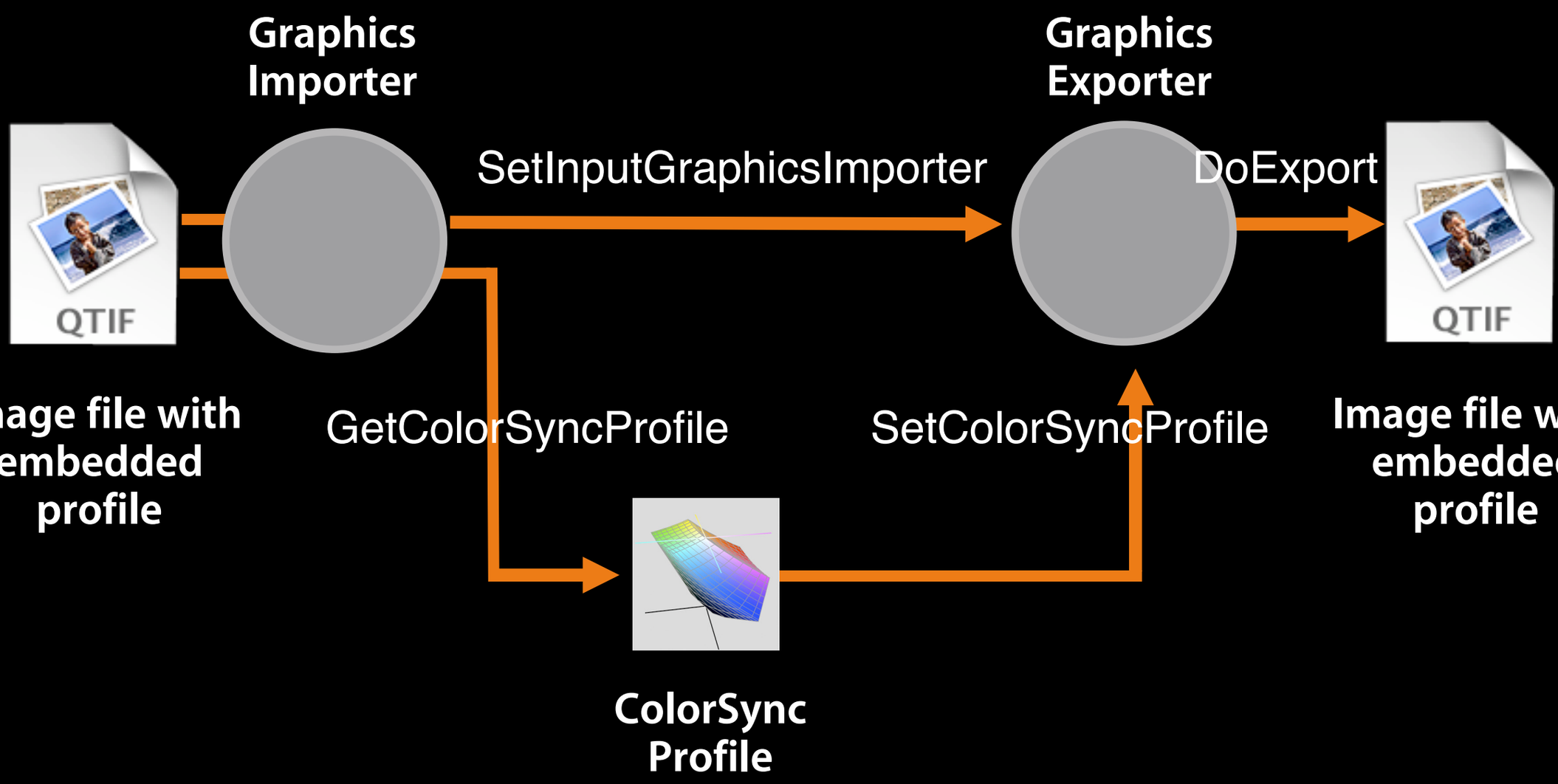
Using Them Together

- Drawing matched images has involved writing extra code
- Preserving profiles has involved writing extra code
- Many applications do not bother!

Matching Manually



Preserving Profiles Manually

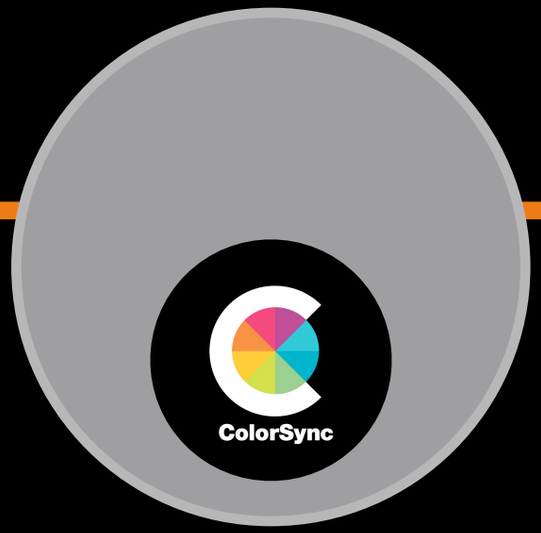


Changes in Panther

- Drawing
  - Images with profiles are drawn matched by default
  - ColorSync's CMYK to RGB conversion used by default
- Converting
  - Profiles are preserved by default when using `GraphicsExportSetInputGraphicsImporter`

Matching Automatically

Image file with embedded profile



Graphics Importer Using ColorSync

Draw

GWorld or Window

(Matched to Generic RGB)

Demo:
ColorSync Matching in Graphics Importers

Sam Bushell

Pick the Correctly-Matched Image

Trick ColorSync Profiles

The embedded test profile is not used and is not double matched

Wrong—Not matched

The embedded test profile is used and is not double matched

Right—Matched

The embedded test profile is used and is double matched

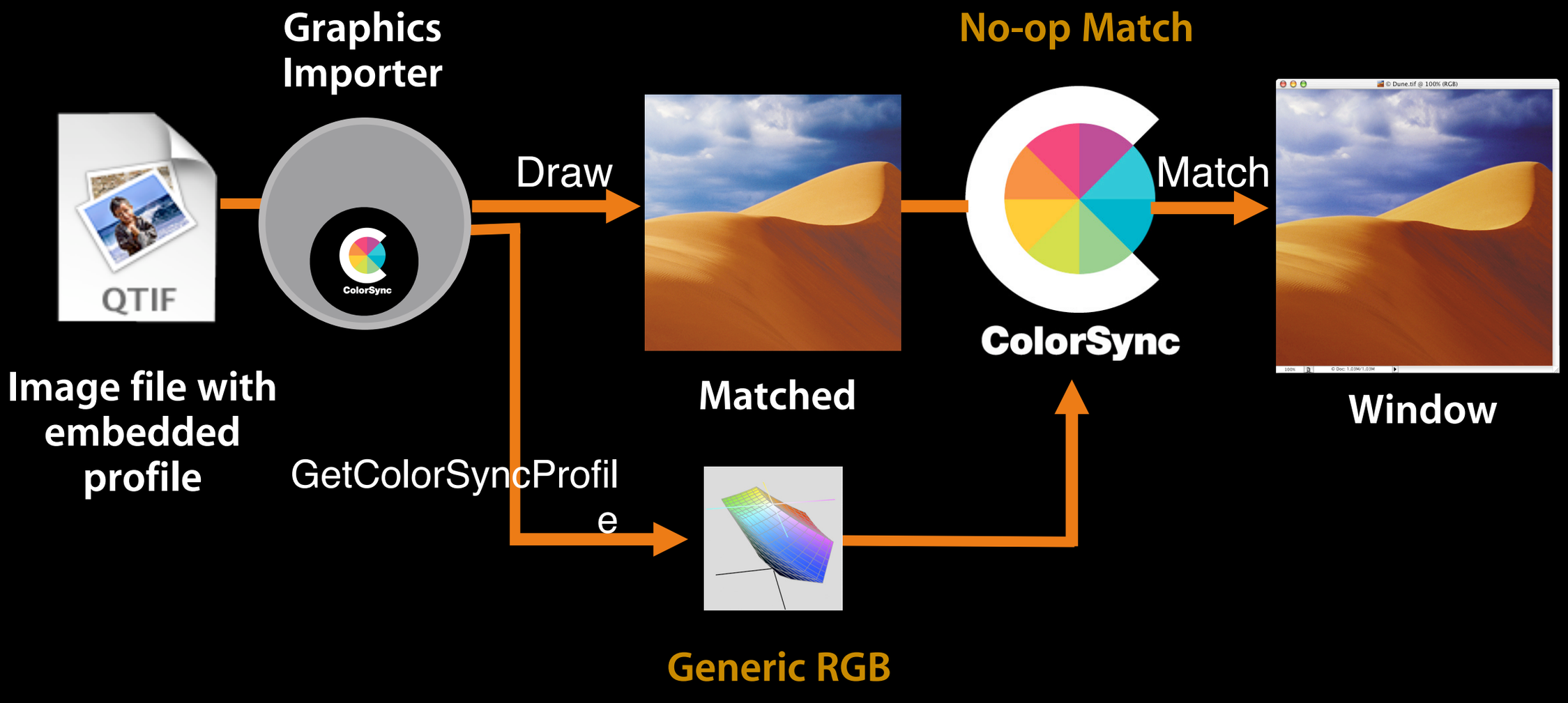
Wrong—Double-matched

Demo:
ColorSync Test Images With Trick Profiles

What If Your Application Already Does ColorSync Matching?

- Important to avoid “double-matching”

Compatibility Mode



Compatibility Mode

- `GraphicsImportGetColorSyncProfile` will return a generic profile if `GraphicsImportDraw` will match

- To disable automatic color matching:
  `GraphicsImportGetFlags(gi, &flags);`
  `GraphicsImportSetFlags(gi, flags`
  `  | kGraphicsImporterDontUseColorMatching);`

- Then `GraphicsImportGetColorSyncProfile` will return the actual embedded profile
- Note: It is safe to set this flag on all Mac OS X releases

Caveats

- In the WWDC seed, automatic color matching only happens in `GraphicsImportDraw`
- Not yet in `GraphicsImportGetAsPicture`, `GraphicsImportSaveAsQuickTimeImage` etc.

Calling Importer Developers

- Enable this feature for your graphics importer!

Summary

- QuickTime is working harder to help your apps match and preserve profiles
- If you do matching yourself, set a flag

QuickTime and Quartz 2D

Sam Bushell
QuickTime Engineering

New API: GraphicsImportCreateCGImage

- Draws the image into a new CGImageRef
- Easy to integrate still images into Quartz drawing

New API: GraphicsExportSetInputCGImage

- Uses a CGImageRef as input
- Easy to export Quartz drawings to many image formats

Audio/Video Startup Sync

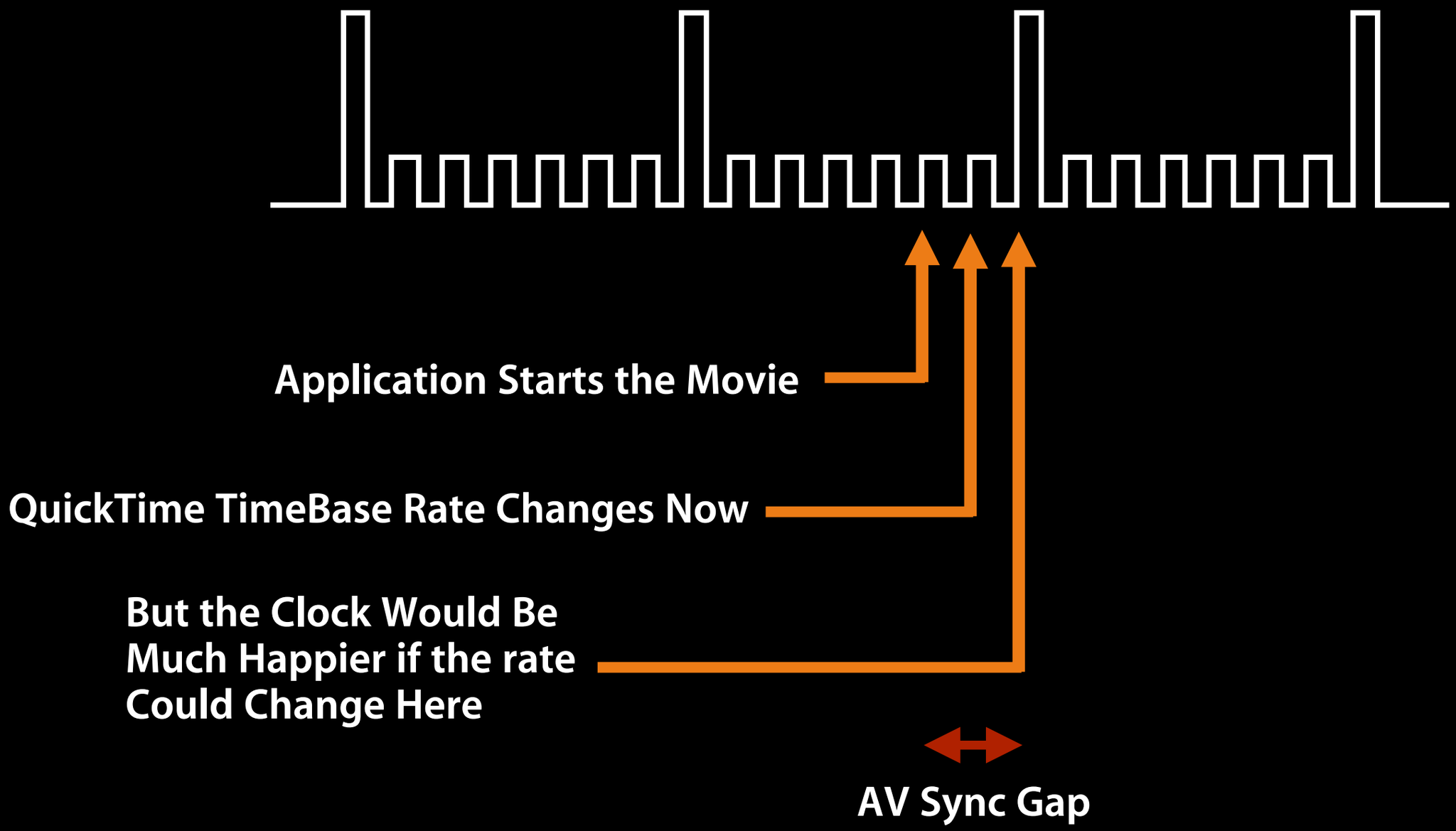
Jean-Michel Berthoud
QuickTime Engineering

A/V Sync Today

- Movie time is driven by TimeBases
- TimeBases are driven by clocks
- Clocks can be provided by devices (audio or video)
- Address A/V sync issues over long period of time
- But TimeBase rate changes happen immediately…

The Startup Sync Problem

An Imaginary Video Clock



A/V Startup Sync

- Understands clock constraints
- Provides “headroom” before rate changes

How Does QuickTime Know?

- `ClockGetTimeForRateChange`
- `ClockGetRateChangeConstraints`

New for TimeBases

- `GetTimeBaseRateChangeStatus`
- new GetTimeBaseStatus flag: `timeBaseRateChanging`

What Does That Mean for an Application?

- Clock rate can be non-zero but time is not moving
- new GetTimeBaseStatus flag: `timeBaseRateChanging`
  i.e. you are inside the “gap”
- Use `GetMovieRateChangeConstraints` to query minimum and maximum delay

Demo:
A/V Startup Sync

Wrap Up

Roadmap

701 QuickTime State of the Union	The Presidio Tue., 9:00am
708 QuickTime APIs Update	Pacific Heights Tue., 5:00pm
711 Audio and QuickTime	Russian Hill Wed., 9:00am
727 QuickTime Streaming Server Programming	The Mission Thu., 2:00pm
730 QuickTime Alternative Programming Environments	Pacific Heights Fri., 10:30pm
FF011 QuickTime	Haight/Ashbury Thu., 3:30pm

Who to Contact

Guillermo Ortiz
QuickTime Technology Manager
quicktimeman@apple.com

http://developer.apple.com/wwdc2003/urls.html

For More Information

Reference Library

Documentation

QuickTime

ADC Home > Documentation > QuickTime >

ColorSync

ADC Home > Documentation > Graphics & Imaging > ColorSync

Quartz 2D

ADC Home > Documentation > Graphics & Imaging > Quartz

Reference Library

Documentation

General Information

http://www.apple.com/quicktime

Developer Information

http://developer.apple.com/documentation

QuickTime Information

http://developer.apple.com/quicktime

Reference Library

Sample Code

ThreadTesterPro / ThreadsExporter / ThreadsExportMovie

ADC Home > Log in > Download Software > WWDC 2003

DropDraw / Image Files with Trick Profile

ADC Home > Log in > Download Software > WWDC 2003

Do Not Miss!

Lab: QuickTime Content Creation

Meet with QuickTime content experts for daily content specific topics that are of special interest to you. Bring your own media and Powerbook. No appointment is needed—first-come, first-served.

Sacramento Room

Lab: QuickTime Development

Meet with Apple's QuickTime engineers. Each day will emphasize a specific QuickTime development topic. Bring your own code and Powerbook. No appointment is needed—first-come, first-served.

Sacramento Room

Lab Hours

Monday	12:00pm to 6:00pm
Tuesday	9:00am to 6:00pm
Wednesday	9:00am to 6:00pm
Thursday	9:00am to 4:30pm
Friday	9:00am to 6:00pm

Q&A

Guillermo Ortiz
QuickTime Technology Manager

http://developer.apple.com/wwdc2003/urls.html

WWDC 2003

Worldwide Developers Conference